

WHAT IS CLAIMED:

1. A method for controlling an internal combustion engine having a plurality of cylinders, at least  
5 some of which are selectively deactivated in a variable displacement operating mode, and at least one actuator associated with the selectively deactivated cylinders, the method comprising:

10 deactivating at least some of the plurality of cylinders; and

controlling the at least one actuator while the cylinders are deactivated based on operating conditions associated with the activated cylinders to reduce torque excursions associated with reactivation of the deactivated  
15 cylinders.

2. The method of claim 1 wherein the at least one actuator includes a variable cam timing device and wherein the step of controlling comprises pre-positioning  
20 the variable cam timing device based on engine speed and manifold pressure associated with the activated cylinders.

3. The method of claim 1 further comprising:  
determining engine speed;  
25 determining pressure associated with the activated cylinders; and

wherein the step of controlling includes controlling at least one valve actuator to achieve a desired cylinder air charge in the deactivated cylinders.

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4. The method of claim 1 wherein the step of controlling comprises positioning a throttle valve

associated with the deactivated cylinders based on a desired cylinder air charge.

5           5.    The method of claim 1 further comprising:  
              determining engine speed;  
              determining manifold pressure associated with the  
activated cylinders;  
              determining a desired cylinder air charge; and  
              wherein the step of controlling includes  
10   controlling a variable cam timing device based on the engine  
speed and the manifold pressure to provide the desired  
cylinder air charge in the deactivated cylinders upon  
reactivation.

15           6.    A method for controlling a variable  
displacement internal combustion engine having at least two  
banks of cylinders, each bank having an associated dedicated  
intake manifold, plenum, and variable cam timing mechanism,  
the method comprising:  
20                determining a desired torque;  
                  determining engine speed;  
                  determining a cylinder air charge based on the  
desired torque, the engine speed, and the number of  
activated cylinders; and  
25                controlling the variable cam timing mechanism  
associated with deactivated cylinders based on the cylinder  
air charge and operation of all cylinders prior to  
reactivation of the deactivated cylinders.

30           7.    The method of claim 6 wherein the engine  
includes a dedicated throttle valve associated with each  
bank of cylinders, the method further comprising:

controlling the throttle valve associated with deactivated cylinders based on the cylinder air charge and operation of all cylinders prior to reactivation of the deactivated cylinders.

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8. A computer readable storage medium having stored data representing instructions executable by a computer for controlling an internal combustion engine having a plurality of cylinders, at least some of which are selectively deactivated in a variable displacement operating mode, and at least one actuator associated with the selectively deactivated cylinders, the computer readable storage medium comprising:

instructions for deactivating at least some of the plurality of cylinders;

instructions for controlling the at least one actuator while the cylinders are deactivated based on operating conditions associated with the activated cylinders to reduce torque excursions associated with reactivation of the deactivated cylinders.

9. The computer readable storage medium of claim 8 wherein the at least one actuator includes a variable cam timing device and wherein the instructions for controlling include instructions for pre-positioning the variable cam timing device based on engine speed and manifold pressure associated with the activated cylinders.

10. The computer readable storage medium of claim 8 further comprising:

instructions for determining engine speed;

instructions for determining pressure associated with the activated cylinders; and

wherein the instructions for controlling include instructions for controlling at least one valve actuator to achieve a desired cylinder air charge in the deactivated cylinders upon reactivation.

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11. The computer readable storage medium of claim 8 wherein the instructions for controlling comprise instructions for positioning a throttle valve associated with the deactivated cylinders based on a desired cylinder air charge.

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12. The computer readable storage medium of claim 8 further comprising:

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instructions for determining engine speed;  
instructions for determining manifold pressure associated with the activated cylinders;  
instructions for determining a desired cylinder air charge; and

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wherein the instructions for controlling include instructions for controlling a variable cam timing device based on the engine speed and the manifold pressure to provide the desired cylinder air charge in the deactivated cylinders upon reactivation.

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13. A system for controlling an internal combustion engine having a plurality of cylinders, at least some of which are selectively deactivated in a variable displacement operating mode, the system comprising:

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at least one actuator for modifying pressure associated with the selectively deactivated cylinders during reactivation, and

a controller in communication with the at least one actuator for positioning the at least one actuator while

the cylinders are deactivated based on operating conditions associated with the activated cylinders to reduce torque excursions associated with reactivation of the deactivated cylinders.

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14. The system of claim 13 wherein the at least one actuator comprises a variable cam timing device and wherein the controller pre-positions the variable cam timing device based on engine speed and manifold pressure associated with the activated cylinders.

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15. The system of claim 13 further comprising:  
an engine speed sensor; and  
means for determining pressure associated with the activated cylinders;  
wherein the controller generates signals to control at least one valve actuator to achieve a desired cylinder air charge in the deactivated cylinders.

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16. The system of claim 13 further comprising:  
a dedicated electronically controlled throttle valve associated with the deactivated cylinders and in communication with the controller, wherein the controller positions the throttle valve based on a desired cylinder air charge.

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17. The system of claim 13 further comprising:  
an engine speed sensor in communication with the controller;

a manifold pressure sensor associated with the activated cylinders and in communication with the controller; and

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a variable cam timing mechanism for modifying intake and/or exhaust valve timing in response to a command from the controller;

5 wherein the controller determines a desired cylinder air charge and controls the variable cam timing mechanism based on the engine speed and the manifold pressure to provide the desired cylinder air charge in the deactivated cylinders upon reactivation.

10 18. A system for controlling a variable displacement internal combustion engine having at least two banks of cylinders, each bank having an associated dedicated intake manifold, plenum, and variable cam timing mechanism, the system comprising:

15 means for determining a desired torque;  
means for determining engine speed;  
means for determining a cylinder air charge based on the desired torque, the engine speed, and the number of activated cylinders; and

20 means for controlling the variable cam timing mechanism associated with deactivated cylinders based on the cylinder air charge and operation of all cylinders prior to reactivation of the deactivated cylinders.

25 19. The system of claim 18 wherein the engine includes a dedicated throttle valve associated with each bank of cylinders, the system further comprising:

30 means for controlling the throttle valve associated with deactivated cylinders based on the cylinder air charge and operation of all cylinders prior to reactivation of the deactivated cylinders.

20. A system for controlling an internal  
combustion engine having a plurality of cylinders, at least  
some of which are selectively deactivated in a variable  
displacement operating mode, and at least one dedicated  
5 actuator associated with the selectively deactivated  
cylinders, the method comprising:

means for deactivating at least some of the  
plurality of cylinders in a variable displacement operating  
mode; and

10 means for controlling pressure of the deactivated  
cylinders based on operating conditions associated with the  
activated cylinders to reduce torque excursions associated  
with reactivation of the deactivated cylinders.